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ART 34 AMDT

pack impairs appearance. Furthermore, the amount of fat discharged is in principle related to the undesired alteration of the taste of the sausage. In parallel with the discharge of fat, mention may also be made here of loss of moisture and the related drying effect.

It was therefore an object of the invention to develop a process which considerably reduces or indeed entirely prevents fat discharge when the synthetic casing section is closed, so that a second pack is sometimes unnecessary. In addition to this, the intention is that the production of the sections closed at one end should become more rational and less expensive than hitherto.

The object has been achieved via the closure at one end of the synthetic casing with a flat seam, which is a jointing seam sewn which can be produced via welding, sealing, or adhesive bonding. Where appropriate, the closed end also has a decorative seam or a printed imitation of a seam, e.g. with feel enhanced by an embossment.

The present invention therefore provides sections of a tubular foodstuff casing closed at one end with a flat transverse seam, wherein the seam is a jointing seam. The jointing seam is preferably a sealed seam, welded seam, or adhesive seam.

The tubular casing has one or more layers. For its production, use may be made of a very wide variety of materials. Examples of suitable materials are polyolefins (specifically polyethylene, polypropylene, polybutylene, ethylene-α-olefin copolymers, propylene-α-olefin copolymers, or ethylene-propylene-α-olefin terpolymers), polyamides (specifically aliphatic and partly aromatic

polyamides, and also mixtures of these), polyesters, polyvinyl chloride, polyvinylidene chloride, polyurethane, polyacrylonitrile, polyether, polycarbonate, thermoplastic starch, starch derivatives (such as starch acetate), ethylene-vinyl acetate copolymers. Mixtures composed of two or more of the abovementioned materials may also be used. In the case of the multilayer casings, use may also be made of other materials with specific properties, for example moisture-sensitive polymers with oxygen-barrier properties (i.e. in particular ethylene-vinyl alcohol (EVOH) copolymers) or polymers with adhesion-promoting properties. It is also possible to use casings based on (regenerated) cellulose, and these may, where appropriate, have a fiber reinforcement, or else casings based on uncoated or coated (specifically acrylate-coated) textile material.

The wall thickness of the tubular casing depends on the nature of the material, on the subsequent use, and also on the caliber (a higher-caliber casing generally also having higher wall thickness). It is generally from 30 to 150 µm, preferably from 40 to 90 µm. Casings composed of coated textile material are generally somewhat thicker (generally from about 50 to 200 µm).

The casing may be an unoriented or oriented casing, and the oriented casings here have generally been biaxially oriented and generally also heat-set. Examples of suitable casings are therefore those composed of unoriented polyamide (uPA) or of at least one layer composed of uPA. The biaxial orientation may take place in a blown-film process or in what is known as a "double-bubble" process. The longitudinal and transverse shrinkage of the oriented tubular foodstuff casing on heating to up to 90 °C (water bath, 5 min) is generally

REPLACED BY
ART 34 AMDT

not more than 20 %, preferably not more than 15 %.

Heat-sealable casings are particularly useful for the purposes of the present invention. These are generally multilayer casings in which at least the inner layer (subsequently in contact with the foodstuff) is heat-sealable. It is generally produced via coextrusion, advantageously with the aid of an annular coextrusion die.

The heat-sealable layer located on the inner side is generally composed of a thermoplastic material whose melting point is lower than that of the actual backing layer. For practical purposes, preference is given to a sealable layer composed of a thermoplastic material whose melting point is up to 150 °C. The heat-sealable layer therefore comprises as substantial constituent or as principal constituent, by way of example, a polyolefin, in particular a polyethylene (specifically an LDPE or LLDPE) or an ethylene copolymer, specifically an ethylene-propylene copolymer, an ethylene-vinyl acetate copolymer, or an ethylene-(meth)acrylic acid copolymer or a salt thereof, and the last named may also be termed ionomers. Ionomers moreover have very good adhesion-promoting properties with respect to various other plastics and therefore tend to prevent undesired delamination of the multilayer foodstuff casing. The heat-sealability may moreover be improved with the aid of metal salts of fatty acid, e.g. calcium stearate.

A heat-sealable coating may also be sufficient for some applications, instead of a heat-sealable layer on the inner side. This coating can be produced via application of a corresponding coating liquid and subsequent drying. However, the sealable coatings thus produced are

relatively thin (from about 10 to 300 nm), and there are therefore restrictions on the resultant achievable sealed seam strength. Furthermore, the inner side of seamless tubular films can be coated only at high technical cost, and therefore this alternative is in practice only important for flat films which then are sealed to give tubular films in a further step.

The backing layer(s) in the multilayer tubular foodstuff casing are preferably composed of aliphatic and/or partly aromatic polyamide and/or copolyamide (such as PA 6, PA 66, PA 6I/6T, PA 6/66, PA 46, PA 610, or PA 612). These polyamide layers intrinsically have a certain degree of barrier action with respect to oxygen and aroma constituents. They absorb up to about 6 % by weight of water. This applies particularly to layers composed of aliphatic polyamide or copolyamide. Where appropriate, the polyamides or copolyamides of the backing layer(s) may have been blended with other polymers, in particular with polyolefins. Their proportion is then generally less than 50 % by weight, based on the weight of the backing layer. It is especially the mechanical properties of the foodstuff casing that are determined via the backing layer(s). The backing layers generally have a thickness of from 10 to 100 μm, preferably from 20 to 60 μm.

One preferred embodiment of the foodstuff casing moreover comprises at least one water-vapor- and/or oxygen-barrier layer. The result is to eliminate or markedly reduce weight loss on storage, i.e. drying the foodstuff. A good oxygen barrier is particularly important for highly air-sensitive foodstuffs. By way of example, barrier layers are composed of polyvinylidene chloride (PVDC) or of vinylidene chloride copolymers, polyvinyl chloride (PVC), ethylene-vinyl alcohol (EVOH) copolymers, or polyethylene

terephthalate (PET). Barrier layers composed of chlorine-free materials are more advantageous for environmental reasons. The barrier layers generally have a thickness of (in each case) from 4 to 25 µm, preferably from 5 to 15 µm.

Between the individual layers there are also frequently relatively thin adhesive layers (thickness therefore less than about 4 µm). Adhesive layers are necessary or advantageous if layers composed of different polymers come into contact. By way of example, polyolefin layers and polyamide layers have only relatively low mutual adhesion, and this therefore makes it advisable to use adhesive layers. However, adhesion-promoting components may also have been directly admixed with one or both of the layers coming into contact. Examples of suitable components of this type are polyolefins which have functional groups (in particular carboxy groups).

The inner side of the tubular foodstuff casing has always to have adequate adhesion to the emulsion. Excessive adhesion has to be avoided, in order to permit fully satisfactory subsequent removal of the foodstuff casing by peeling. However, excessively weak adhesion is also to be avoided, otherwise what is known as a gel deposit can easily form between sausage emulsion and casing, and this is often perceived by consumers as a quality defect.

The tubular foodstuff casing usually has a straight shape. However, it may also have been bent (ring casing) or be formed regularly or irregularly (imitation of natural gut). The caliber of the casing is generally from 30 to 60 mm for ring casing, from 20 to 50 mm for small-caliber synthetic casing, from 50 to less than 80 mm for medium-caliber synthetic casing. Casings suitable for the

purposes of the present invention are usually seamless, i.e. have no longitudinal seams. However, they may in principle be produced from flat film which is then folded to give a tube, which is then secured via welding or via sealing - if appropriate with use of a sealing band. However, the casing frequently does not have the same mechanical strength and the same shrinkage properties in the region of the longitudinal seam as in the other regions of the casing. Leaks can also occur. Casings with longitudinal seam are therefore generally less preferred.

In contrast to hot sealing, welding can take place without contact, for example via action of laser beams (in particular IR laser beams with a wavelength of from 600 to 1200 nm) or high-frequency radiation. However, temperature control is less precise in these processes. Welding processes are also suitable for single-layer foodstuff casings. Welding may also have been combined with separation of the individual sections (seam-welding and cutting). Markings printed onto the foodstuff casing (print marks) and corresponding scanning sensors can be used to control precisely where the flat sealed seam, welded seam, or adhesive seam is to be produced.

In addition to the sealed seam, welded seam, or adhesive seam, a sewn seam may be present. This may be a "genuine" seam, in which the sewing material passes through the casing, and which then also contributes to the mechanical stability of the end closure. However, care then has to be taken that the perforation of the casing brought about by the sewing needle does not extend beyond the region of the sealed seam, welded seam, or adhesive seam, in order not to increase the likelihood of leakage of fat. It can be advantageous here to use a sewing material composed of a swellable material. Suitable materials for this purpose

are known from the textile industry. The seam produced with sewing material also has a decorative function. Use of single- or multicolor sewing material can further raise the level of this decorative effect. In addition, this can also be used to indicate the factory of origin.

In another embodiment, the seam is located on a separate strip of material and this decorative seam or braid is applied to, or immediately adjacent to, the sealed seam, welded seam, or adhesive seam. The bonding of the braid to the casing may in turn take place via sealing, welding, or adhesive bonding. Where appropriate, therefore, the sealing, welding, or adhesive bonding of the casing to produce the flat transverse seam and the application of the braid may have been combined in a single step. The combination mentioned also provides mechanical reinforcement of the transverse seam.

Finally, the sewn seam can also be imitated via embossing or printing. Here again, care has to be taken to avoid damage to the sealed seam, welded seam, or adhesive seam.

An adhesive seam can be produced with the aid of suitable adhesives, in particular hot-melt adhesives or contact adhesives. It has the advantage that it can also close casings composed of nonsealable and non-weldable material. These are in particular casings composed of uncoated or coated textile material (in particular composed of acrylate-coated woven material), composed of knitted products, composed of nonwoven, or composed of non-fiber-reinforced or fiber-reinforced cellulose (fiber casing). The nature of the adhesive depends on the casing material. For example, polyurethane adhesives or PVDC dispersion adhesives are particularly suitable for fiber casings. Acrylate adhesives are also generally suitable.

In order to permit production of an adhesive seam, however, the casing must previously have been cut into individual sections of appropriate length. In the case of the sealed seam or welded seam, that is not necessary. Here, the casing can be rolled up (again) after application of the seam and, if appropriate, of the other applications described. The casing is then not separated into individual sections until immediately prior to stuffing. This "stuffing on the roll" permits a high degree of simplification and automation of the production of the sausages. DE-A 102 17 132, which is not a prior publication, describes an appropriate process for automatic stuffing, and also an apparatus for that purpose.

Some types of casing are permeable to hot smoke or cold smoke. By way of example, this applies to the non-fiber-reinforced or fiber-reinforced casings based on regenerated cellulose, and also to casings based on thermoplastic starch. Others may have been impregnated on the inner side with liquid smoke or dry smoke. This particularly applies to the single- or multilayer casings described above and based on synthetic polymers which have low permeability not only to water vapor and oxygen but also to hot smoke or cold smoke.

Processes and apparatus for the sealing, welding, or adhesive bonding of a tubular foodstuff casing are known per se. Apparatus for heat-sealing generally encompasses heated sealing jaws which are brought directly into contact with the surfaces to be sealed.

Casing sections of appropriate length can be shirred to give what are known as sticks. These are then correspondingly short (therefore also termed

"ministicks"). These ministicks are preferably ready for stuffing, i.e. they require no prior water treatment or other pretreatment.

Once the sections have been stuffed, the other end of the casing is closed in a conventional manner, for example via a plastics or metal clip. Tying with yarn is also possible, although more complicated.

Example 1: (Teewurst bags)
Bags with a welded seam and additional sewn closure were produced from a smoke-permeable, single-layer, seamless casing (®NaloFlex R) with a diameter of 45 mm (caliber 45) and a wall thickness of about 25 µm, composed in essence of 35 % by weight of polyesteramide and 65 % by weight of aliphatic polyamides. These were stuffed with teewurst composition and then cold-smoked.

Example 2: (Teewurst bags)
Bags with an adhesive seam and additional sewn closure were produced from a fiber-reinforced casing based on cellulose (®NaloFaser) of caliber 40. The bags could be stuffed without difficulty with teewurst composition and then cold-smoked.

Example 3: (Long-shelf-life-sausage bags)
Bags with a sealed seam and often with an embossed or printed decorative seam were produced from a single-layer, seamless casing (®NaloStar) with a wall in essence composed of about 40 % by weight of thermoplastic starch and 60 % by weight of polyurethane and a diameter of 45 mm, the wall thickness being 100 µm. The bags could be stuffed without difficulty with long-shelf-life sausage composition and then subjected to a ripening process.

<u>Example 4</u>: (Liver-sausage bags)

Bags with a sealed seam and decorative seam were produced from a three-layer, seamless casing with PA/PE/PA layer structure (®NaloShape) with a diameter of 50 mm and a wall thickness of 55 μm, and these were then stuffed with liver sausage composition and then cooked. The bags could be processed without difficulty.